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INTRODUCTION.

This REVIEW is based on reports for November, 1889, from 2,217 regular and voluntary observers in the United States and Canada. These reports are classified as follows: 177 reports from Signal Service stations; 120 monthly reports from United States Army post surgeons; 1,407 monthly reports from state weather service and voluntary observers; 17 reports of rainfall observations in Arizona furnished by the United States Geological Survey; 25 reports from Canadian stations; 168 reports through the Central Pacific Railway Company; 303 marine reports through the co-operation of the Hydrographic Office, Navy Department; marine reports through the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, North and South Dakota, Illinois, Indiana, the Iowa Weather Crop Bulletin Service, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Meteorological Report of the Missouri State Board of Agriculture, Nebraska, Nevada, New England, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, and Texas, and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

CHARACTERISTICS OF THE WEATHER FOR NOVEMBER, 1889.

The most important storm of the month over the eastern part of the country appeared on the Texas coast on the morning of the 26th, whence it moved northeastward to the lower lake region by the 27th, attended in the Mississippi and Missouri valleys by rain or snow. During the 27th and 28th the storm increased in strength and swept eastward over the lower lake region, New York, and the Saint Lawrence Valley, attended by snow in the Lake region and the Ohio Valley and Tennessee, heavy rain in New York and New England, destructive gales on the lakes and in the Saint Lawrence Valley and New England, and a heavy snow storm, the first of the season, in the Province of Quebec. A notable feature for November was the heavy snow storm which prevailed in northeastern New Mexico, extreme northern Texas, southwestern Kansas, and southeastern Colorado during the early part of the month. This storm was accompanied by high wind and low temperature and occasioned loss of life and considerable destruction of live stock. Destructive local storms, resulting in loss of life and damage to property, were reported at New Berne, N. C., on the 21st, and in the northern part of Beaufort county, N. C., on the 28th. The severest storms on the north Atlantic Ocean prevailed over and near the Banks of Newfoundland from the 11th to 13th, and over mid-ocean on the 14th, when gales of hurricane force were reported.

The highest temperature reported was 94°, at Casa Grande, Ariz., and Smithville, Ga., and the lowest temperature reported was -28°, at Fort Buford, N. Dak. At Savannah, Ga., Jacksonville, Fla., Vicksburg, Miss., Fort Canby and Neah Bay, Wash., and Astoria, Oregon, the maximum temperature was as high or higher than previously reported for November, and at Augusta, Ga., Lava, N. Mex., and Fort Thomas, Ariz., the minimum temperature was as low or lower than noted for the corresponding month of preceding years. The month was warmer than the average November in the Lake region, upper Ohio valley, northern Minnesota, Canada, the Atlantic coast states, the plateau and Rocky Mountain regions west of the one hundred and tenth meridian, and on the Pacific coast;

elsewhere the weather was cooler than usual. In districts where the temperature was above the average the departures were less than 5°, while in central Texas and central Colorado the departures below the average temperature for November exceeded 5°. At Newburyport and Somerset, Mass., Orono, Me., and Eola, Oregon, the average temperature was the highest ever reported for November, and at Lead Hill, Ark., and Grand Coteau, La., the November, 1889, average temperature was lower than reported for the corresponding month of preceding years. For the period January 1 to November 30, 1889, inclusive, the greatest average excess in temperature is noted for the extreme northwest, where it amounts to 33°.3, and the greatest average deficiency is shown for the southeastern slope of the Rocky Mountains, where it is 23°.2. Frost was reported as far south as Lee county, Fla., on the 30th. The first killing frost of the season occurred in Alabama on the 29th and 30th. In Mississippi all vegetation was reported as having been killed by heavy frost on the 29th. In Texas frost occurred as far south as Brownsville on the 17th. On the Pacific coast frost occurred as far south as Los Angeles, Cal., on five dates.

The heaviest rainfall for the month fell in central Arkansas, where 16.25 inches were reported at Heber, Cleburne Co.; and the precipitation exceeded ten inches in northeastern California, east-central Texas, east-central Pennsylvania, northeastern Maryland, northern New Jersey, extreme southeastern New York, and west-central Connecticut. In areas in the interior of Nevada, extreme northwestern Utah, east-central Arizona, and western Nebraska, no precipitation was reported; and at stations in southern California, the Dakotas, western Minnesota, central Mississippi, and central Florida, less than one-half inch was reported. The precipitation exceeded the average amount for November on the middle Pacific coast, and east of the Rocky Mountains, except on the northeastern slope of the Rocky Mountains, in the extreme northwest, and in the Rio Grande Valley; elsewhere the precipitation was below the average for November. The greatest excesses in precipitation were noted in extreme southeastern New York and in central Arkansas, where the precipitation was six and five inches, respectively, above the average, and the greatest deficiencies

occurred on the coast of Oregon, where the precipitation was more than three inches less than the average amount for November. At Cumberland, Md., Newburyport, Mass., Moorestown and South Orange, N. J., and Wellsborough, Pa., the precipitation for the current month was the heaviest reported for November. The more notable features of the precipitation for the period January 1 to November 30, 1889, inclusive, are: the great excess in the middle Atlantic states, where about one-third more than the usual amount of rain fell, and the marked deficiencies in the extreme northwest and middle plateau region, where the precipitation was about two-thirds of the usual amount for that period. The greatest depth of snow-fall reported was sixty-one inches at Summit, Cal. Forty-seven inches were reported at Breckenridge, Colo.; twenty-nine inches at Roswell, N. Mex.; twenty-eight inches at Cisco, Cal.; twenty-two inches at Green Bay, Wis.; twenty-two inches at Blue Knob, Pa.; and twenty-one inches at Alpena, Mich. On the immediate Atlantic coast snow fell as far south

as extreme southern New Jersey; in the east Gulf states, to northern Georgia; in the west Gulf states, to central Texas; in the plateau region, to extreme southern New Mexico and southeastern Arizona; and in northeastern California, Oregon, and eastern Washington.

Damaging floods, resulting from heavy rain, occurred in various parts of Pennsylvania, New Jersey, and southern New York from the 17th to 21st, and in New England, New Jersey, and Delaware on the 27th and 28th. Navigation was interrupted or suspended by ice on the Mississippi River above Keokuk, Iowa, and on the middle and upper Missouri River. Well-defined auroral displays were noted in North Dakota on the 1st and 26th; in Minnesota and Michigan on the 17th; and in Vermont and Maine on the 17th and 26th. Brilliant meteors were reported at Elyria, N. Y., on the 2d; at Alpena, Mich., on the 10th; at Little Rock, Ark., on the 14th; at Fort Sully, S. Dak., on the 17th; at Yates Centre, Kans., on the 23d; at Berkeley, Cal., on the 25th; and at Palestine, Tex., 27th.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for November, 1889, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on chart ii by isobars. The difference between the mean pressure for November obtained from observations taken twice daily at the hours named and that determined from hourly observations, varied at the stations named below, as follows: At Washington, D. C., Philadelphia, Pa., New York, N. Y., Boston, Mass., Saint Louis, Mo., and Chicago, Ill., the mean of the 8 a. m. and 8 p. m. observations was higher by .017, .009, .010, .013, .006, and .007, respectively, than the true mean pressure, while at Denver, Colo., the mean of the observations taken at these hours corresponded with the mean obtained from hourly observations.

The mean pressure for November, 1889, was highest within an area extending from Colorado northwestward to southern Idaho, where the values rose above 30.25, the highest mean reading, 30.33, being noted at Montrose, Colo. Over the Rocky Mountain and plateau regions, and over the eastern portion of the country, south of the Ohio Valley, the mean pressure was generally above 30.10, and in the Gulf and south Atlantic states rose to 30.15. The mean pressure was lowest in the lower Saint Lawrence valley and in north-central Ontario, where the readings were below 30.00. The mean pressure was below 30.05 on the extreme north Pacific coast, in the British Possessions north of western Montana, and north of a line traced from the central New England coast westward over the lower lake region, and thence northwestward over northern Michigan and Lake Superior.

A comparison of the pressure chart for November, 1889, with that of the preceding month shows that a general increase in pressure occurred, except in northern New England, northern New York, the upper and lower lake regions, the Ohio, upper Mississippi, and Red River of the North valleys, and in Canada east of the one-hundredth meridian. The most marked increase in pressure occurred within an area extending from Colorado northwestward to Idaho, where the mean readings were more than .20 higher than for the preceding month, from which region the increase became gradually less marked northward, and towards the Gulf, Atlantic, and Pacific coasts. Over the northern portion of the upper lake region the decrease in pressure was more than .10, whence it became gradually less marked to a line indicating no change in pressure traced from western Nova Scotia westward to central New York, thence southwestward over the Ohio Valley, and thence northwestward to Manitoba. For October, 1889, the area of highest mean pressure occupied the upper Mississippi and Missouri valleys and the upper lake region, with included values above 30.15, and a well-defined area of low pressure embraced a part

of the southern plateau region. For the current month the area of highest pressure appeared over parts of the middle plateau region and the middle-eastern slope of the Rocky Mountains, with mean readings about .10 higher than the highest means noted for the preceding month, and no area of low pressure appeared within the region of observation.

The mean pressure for November, 1889, was generally above the normal from the Mississippi River and the upper lake region to the Pacific coast, in New England, and along the immediate Atlantic coast. The mean pressure was below the normal in the Saint Lawrence Valley, and thence southwestward to the east Gulf coast. The departures above the normal pressure were greatest over the middle-eastern slope of the Rocky Mountains, where, at stations, they amounted to .08; the departures below the normal pressure did not exceed .03.

BAROMETRIC RANGES.

The monthly barometric ranges at the several Signal Service stations are shown in the table of miscellaneous meteorological data. The general rule, to which the monthly barometric ranges over the United States are found to conform, is that they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In November, 1889, the monthly ranges were greatest on the southeast coast of New England, where they exceeded 1.30, whence they decreased southward to less than .40 over southern Florida, and westward to less than .90 over Montana, from which latter-named region they increased to more than 1.20 on the extreme north Pacific coast. On the Pacific coast the ranges decreased southward to less than .40 on the coast of southern California. Along the Atlantic coast the extreme monthly ranges varied from .33 at Key West, Fla., to 1.34 at Boston, Mass.; between the eighty-second and ninety-second meridians, .64 at Cedar Keys, Fla., to 1.26 at Port Huron, Mich.; between the Mississippi River and the Rocky Mountains, .73 at Brownsville and San Antonio, Tex., to 1.13 at Saint Vincent, Minn.; in the Rocky Mountain and plateau regions, .42 at Yuma, Ariz., to .94 at Walla Walla, Wash.; on the Pacific coast, .36 at San Diego, Cal., to 1.20 at Port Angeles, Wash.

AREAS OF HIGH PRESSURE.

Seven well-defined areas of high pressure were observed within the limits of the United States during the month of November. They were generally first observed in the region north of Montana and Dakota, although two first appeared west of the Rocky Mountain regions. The general direction of movement was to the southward while passing over the eastern slope of the Rocky Mountains, and to the eastward during the transit over the eastern portion of the United States, the direction of movement becoming slightly to the